6

SPECIAL TOPICS

This chapter addresses topics relating to the fire problem that, because of their severity, require special attention. First, the fire problem of the United States is compared to that of 13 industrial nations. Second, because arson is a very serious problem in the United States, a detailed examination is presented. Third, wildland fires have traditionally been of concern to rural residents, but with the rapid expansion of urban population to rural areas, wildland fires have become a more important and visible problem. Finally, the total cost of fires in the United States is enormous. We have attempted to aggregate the "hidden" cost of fires with the known costs in order to better understand the magnitude of the fire problem.

INTERNATIONAL FIRE COMPARISON

The United States historically has had one of the highest fire loss rates of the industrialized world in terms of both fire deaths and dollars loss. This unenviable status has perplexed many experts in the fire world. The United States is health and safety conscious in many areas—automobiles, consumer products, food, medical drugs—and has a vast arsenal of technological resources to combat fire. Why then is such a safety conscious and technologically advanced society a world leader in fire losses?

This comparison deals with the fire death rates for 13 industrialized nations and the United States. Although comparisons of total fires and total fire losses would be preferable, reliable data are not available due to diverse record keeping and fire classification practices in different countries. Loss estimates can then vary within a country, depending on the source of the information. This is especially true for data regarding monetary loss. In the United States, for example, the monetary loss reported by a fire department can vary significantly from that reported by an insurance company. And both of these estimates may differ from the monetary loss as perceived by the owner or occupant. Fire deaths, however, are less controversial as they are more readily identified and consistently counted, although they too have reporting problems.

Death Rates

Figure 129 depicts the average per capita fire death rates for 14 industrialized nations from 1979 to 1992. As this figure demonstrates, the United States ranked only behind Hungary as having the highest per capita fire death rate. At a rate of 26.5 deaths per million population, the United

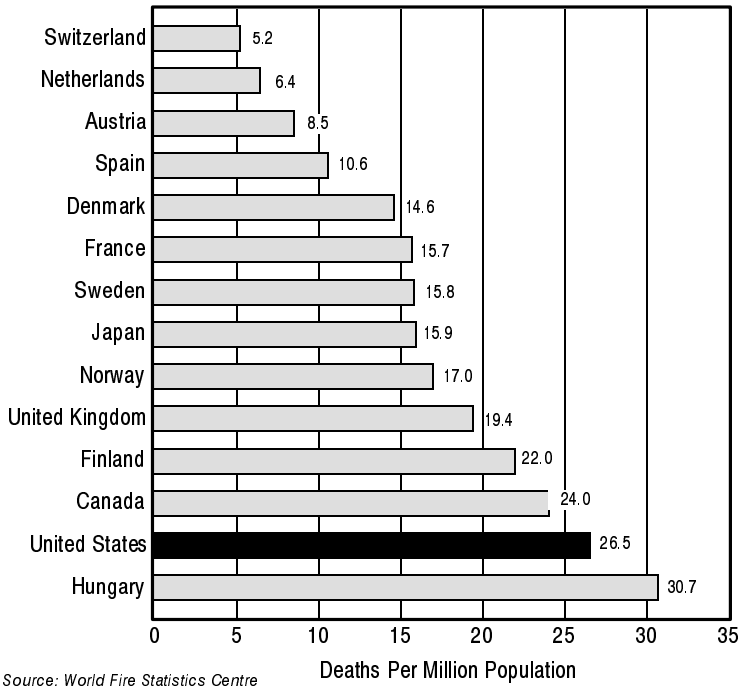


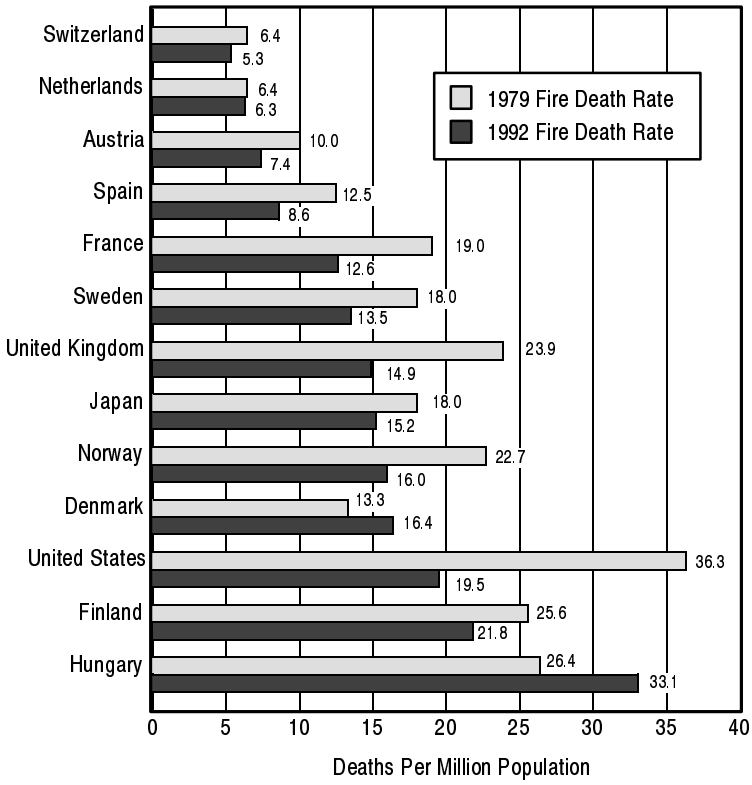
Figure 129. Average Fire Death Rate by Country (1979–92)

States' fire death rate was more than five times that of Switzerland, which had the lowest rate of all the countries considered—5.2 deaths per million population.

Figure 130 indicates that, at least in absolute terms, the situation in the United States improved greatly between 1979 and 1992. The U.S. fire death rate fell 46.3 percent, from 36.3 fire deaths per million population in 1979 to 19.5 fire deaths per million population in 1992. This decline, however, was not limited to the United States; rather, it was an international trend. Of the countries considered, only Hungary and Denmark recorded increases in their rates of fire deaths over that period. The reduction of fire deaths for the United States (46 percent, or 16.8 fire deaths per million population) was the largest absolute and relative drop of any of the countries shown, almost twice the size of the next biggest drop—the United Kingdom, with a reduction of 38 percent, or 9 fire deaths per million population.[1]

Despite its impressive gains, the United States still has one of the highest per capita fire death rates among the countries considered, as shown in Figure 131. The most current comparative data (1992) reveal that the United States, while having substantially reduced its fire death rate, is still 30 to 50 percent higher than its peer nations (countries that analysts consider most like the United States). And in the case of Switzerland and the Netherlands, and United States' fire death rate is nearly triple. Many people feel that there is little reason for the United States, which possesses a wealth of advanced fire suppression technologies and fire service delivery mechanisms, to lag so

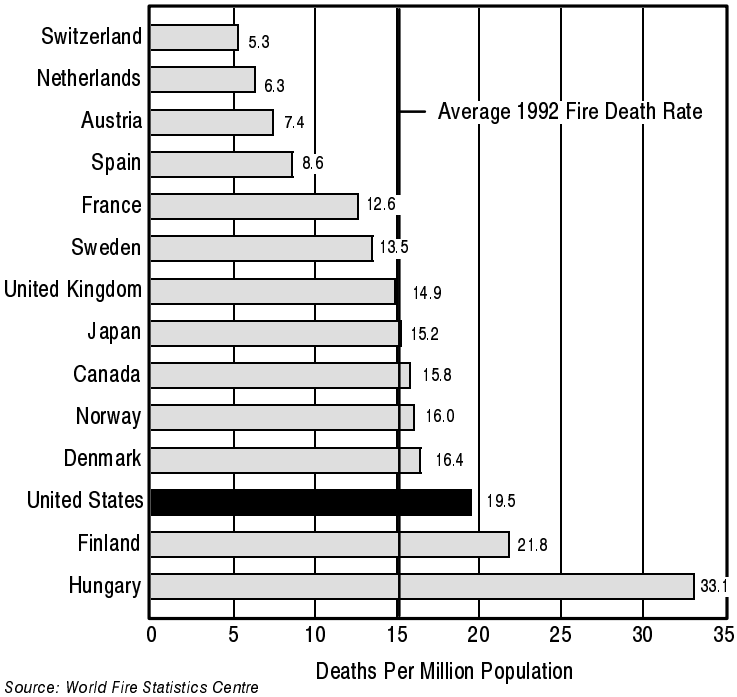
[1] Canada is not considered in this comparison.



Note: Canada is not included as 1979 data were not available

Source: World Fire Statistics Centre

Figure 130. 1979 and 1992 Fire Death Rates Ranked by Percent of Decrease



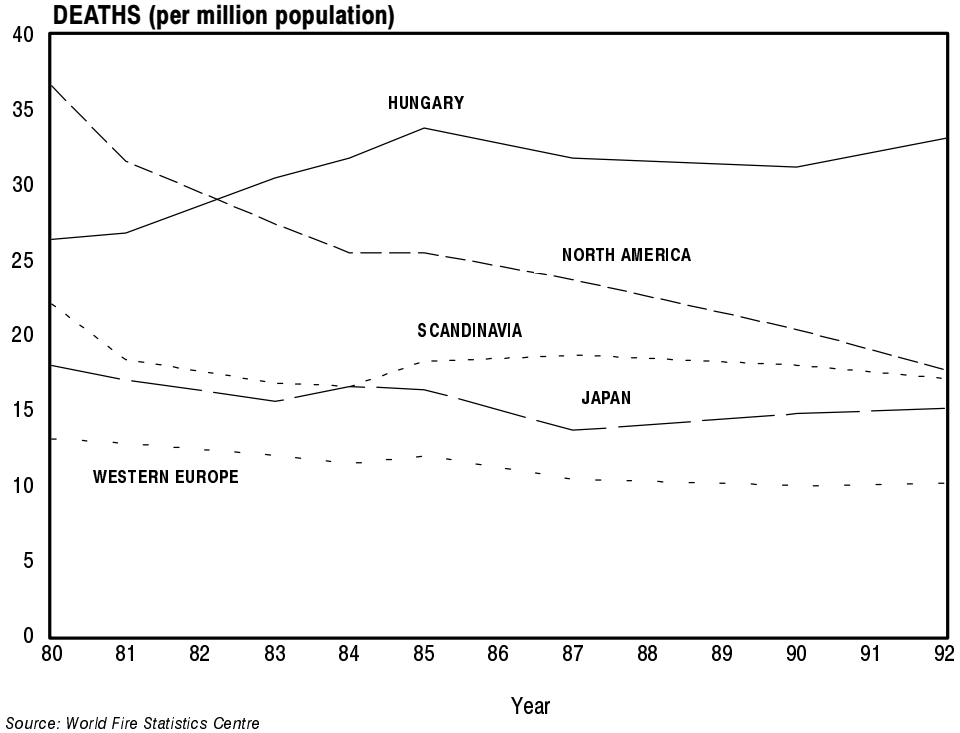
Source: World Fire Statistics Centre

Figure 131. 1992 Fire Death Rate by Country

far behind other nations in terms of fire safety. However, most of the advanced fire technology used in the United States is installed in public places and most fire deaths occur in the home.

Death Rate Trends

Figure 132 compares fire death rate trends for the 14 countries divided into five regional groups: North America (Canada and the United States), Western Europe (Austria, Denmark, France, the Netherlands, Spain, Switzerland, and the United Kingdom), Scandinavia (Finland, Norway, and Sweden), Hungary, and Japan over a 13-year timespan.[2] In this figure, the trend line for North America has a much steeper downward slope than that of the other regions, indicating that North America has reduced its fire death rate significantly more than other regions. In fact, North America experienced a 12.8 percent annual reduction in its fire death rate, compared to a 4.4 percent increase for Hungary, a 2.3 percent reduction for both Scandinavia and Japan, and a 3.8 percent reduction for Western Europe. The trends for Hungary, Scandinavia, and Japan, however, must be viewed with caution, as the data series are for smaller populations and the fit between the trend lines and the data is not as good as those for North America and Western Europe. The poorer fit may well be an indication that the fire loss data gathered in those three areas are less reliable than the data from North America and Western Europe.



Source: World Fire Statistics Centre

Figure 132. Trends in Fire Deaths by Region

[2] Hungary and Japan are reported as "regions" to provide bases for comparison of Eastern Europe and Asia, respectively. The use of a single country to denote the region is necessitated by a paucity of data from those regions.

Conclusions

What can explain the persistently high fire death rates in the United States compared to other countries? The fires of greatest concern are residential fires, since this is where the majority of fire deaths in all countries occur. Although statistical data are not available, the United States is widely believed to have many more residential fires on a per capita basis than the other countries studied. This higher fire rate, as well as the United States' higher fire death rates, are likely a product of several factors:

- *The United States commits fewer resources, both in terms of dollars and staff time, to fire prevention activities than other industrialized countries.* The vast majority of fire department resources are focused on fire suppression rather than on fire prevention. It is estimated that less than 3 percent of all U.S. fire department budgets are allocated to prevention activities, whereas other industrialized countries are spending between 4 and 10 percent of their budgets on prevention.[3]
- *There is greater tolerance in the United States for "accidental" fires.* In other countries, particularly countries in the Pacific Rim, fire safety is explicitly taught in the schools, by other public institutions, and in the home. Fire safety education concentrates on preventing fires that in the United States might be considered accidental such as cooking and heating fires. In many countries, families are stigmatized if a serious fire breaks out in their home and potentially threatens their neighbors' homes.
- *Whether through ignorance or a false sense of confidence, Americans practice riskier and more careless behavior than people in other countries.* Examples of these behaviors include careless smoking, leaving cooking unattended, and improper use of space heaters. These types of fires occur in other countries, but high relative rates of fire deaths suggest that either fires occur much more frequently in the United States or, at a minimum, they are much more severe.

In sum, industrialized countries in Europe and Asia can provide the United States with valuable lessons on reducing the incidence of residential fires and residential fire deaths through fire prevention. U.S. fire departments have many strengths, particularly in the development and use of highly advanced fire suppression technologies and fire service delivery mechanisms. But U.S. fire departments' overall effectiveness in minimizing total dollar and human losses can be significantly enhanced by copying fire prevention practices from other countries.

[3] Schaenman, Philip, "Reinventing Fire Protection," *Firefighter's News*, February–March, 1994, p. 44.

ARSON

Arson is the leading cause of all fires, and it annually kills hundreds of Americans, injures thousands, and equates to billions of dollars in damage to property. More than 500,000 arson fires have been recorded in each of the last 10 years. During 1994, the total number of arson fires was estimated at over 548,000. More than 107,000 of these arson fires occurred in structures, both residential and non-residential. Arson fires also accounted for an estimated 560 fire deaths, 3,440 fire injuries, and $3.6 billion in property damage (Figure 133). The 560 fire deaths in 1994 resulting from arson fires, however, was at a 10-year low, a 37 percent decrease over 1993.[4]

Magnitude of the Arson Problem

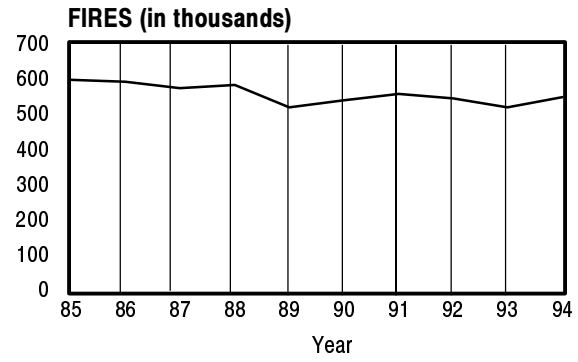
In 1994, arson fires accounted for 28 percent of all fires occurring in the United States, making arson the leading cause of fire (see Figure 31, Chapter 2). In comparison, the second and third leading causes (open flame fires and cooking fires) combined accounted for less than arson fires.

Each year approximately 65–70 percent of arson fires are outdoor fires, 20–25 percent are structure fires, and 10–15 percent are vehicle fires. The 1994 distribution of arson fires and fire losses is shown in Figure 134. Trends in arson fires and deaths are shown in Figure 135. Outdoor arson fires do not kill or injure as many people as structure fires, but they are a cause for serious concern for at least two reasons. First, the proximity of occupied or unoccupied structures to vacant lots or other areas where outdoor arson fires are set increases the risk of exposure fires. Second, outdoor fires are often "gateway" fires, particularly for juvenile firesetters. They begin setting fires in trash cans, fields, or empty lots but then move on to targets that bear increasing risk to persons and property.

Each year arson accounts for a high proportion of all losses due to fire in the United States in terms of lives and property. As shown in Figure 31, Chapter 2, arson fires were responsible for 16 percent of all fire deaths in 1994, making arson the second leading cause of fire deaths and ranking behind only careless smoking as the most deadly cause of fire. Arson was also the second leading cause of fire injuries, accounting for 14 percent of all those injured in fires. Only cooking fires injured more people than arson fires. For direct property losses, arson is the leading cause of property damage due to fire. In 1994 the dollar losses attributable to arson accounted for 28 percent of all fire property losses, twice that of the second leading cause, electrical distribution (14 percent).

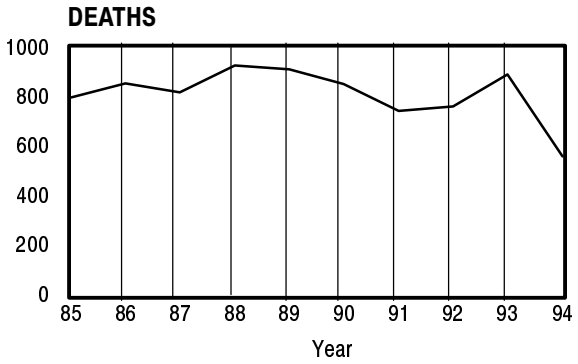
ARSON FIRES IN STRUCTURES—ALL TYPES. Structure fires, while comprising about one-quarter to one-fifth of all arson fires each year, account for a majority of all arson losses (deaths, injuries, and damage to property) (Figure 134). In 1994, 20 percent of all arson fires occurred in structures. These fires alone accounted for 90 percent of all arson fire deaths, 89 percent of all arson fire injuries, and 89 percent of all arson dollar losses.

[4]While "arson" is technically a legal term, it is used here to refer to all fires of incendiary or suspicious origins.



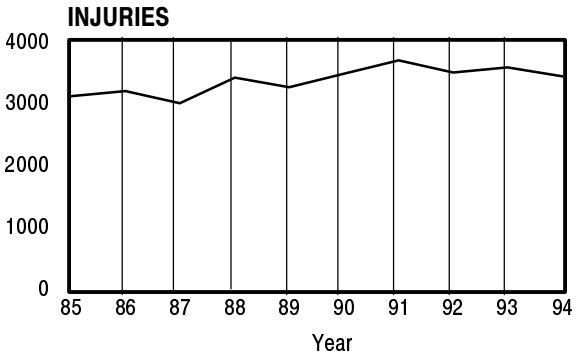
1985	597,500	1990	539,500
1986	592,600	1991	558,100
1987	574,500	1992	545,200
1988	583,400	1993	519,800
1989	519,600	1994	548,500

10-Year Trend = –10.7



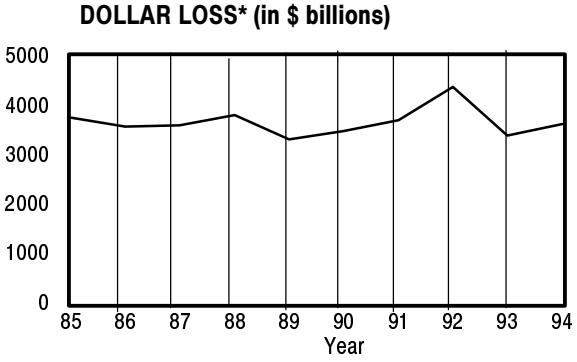
1985	798	1990	851
1986	853	1991	742
1987	818	1992	760
1988	927	1993	889
1989	911	1994	560

10-Year Trend = –17.2



1985	3,120	1990	3,480
1986	3,200	1991	3,700
1987	3,000	1992	3,500
1988	3,420	1993	3,580
1989	3,260	1994	3,440

10-Year Trend = +15.9



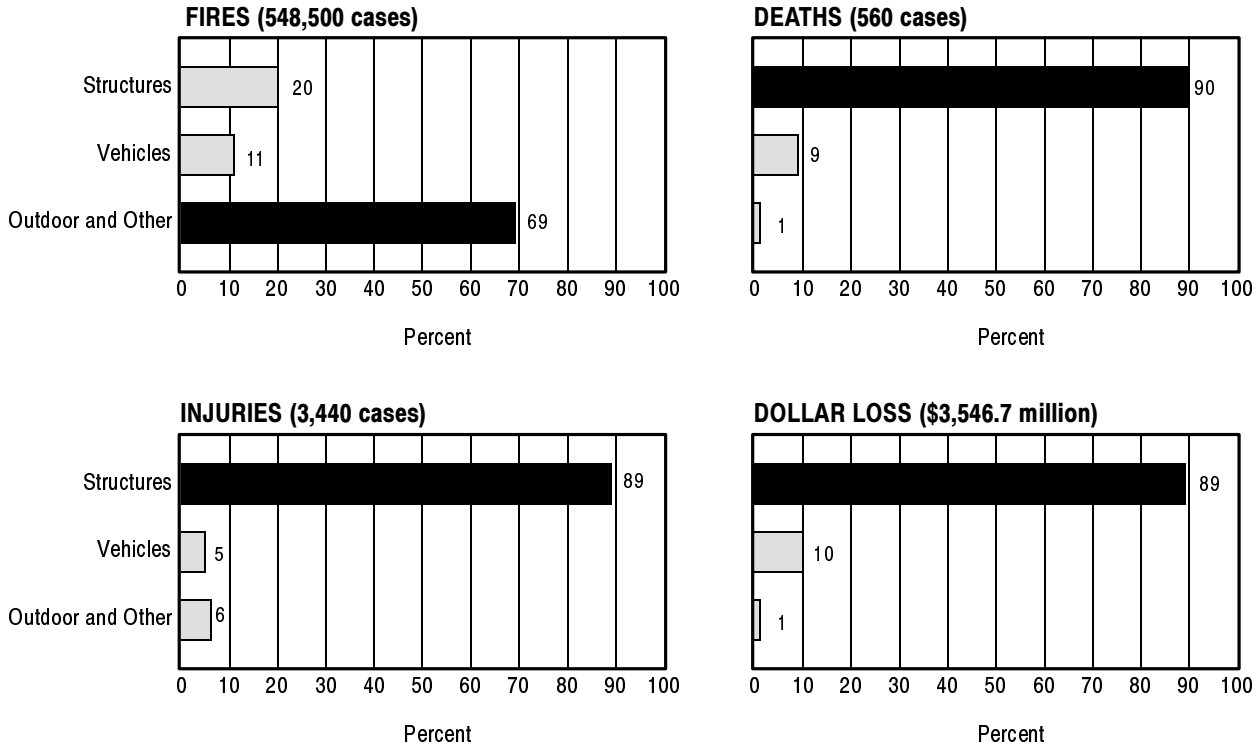
1985	$3.8	1990	$3.5
1986	3.6	1991	3.7
1987	3.6	1992	4.4
1988	3.8	1993	3.4
1989	3.3	1994	3.6

10-Year Trend = +1.9

*Adjusted to 1994 dollars

Sources: NFIRS, NFPA Annual Surveys, and Consumer Price Index

Figure 133. Trends in Arson Fires and Fire Losses



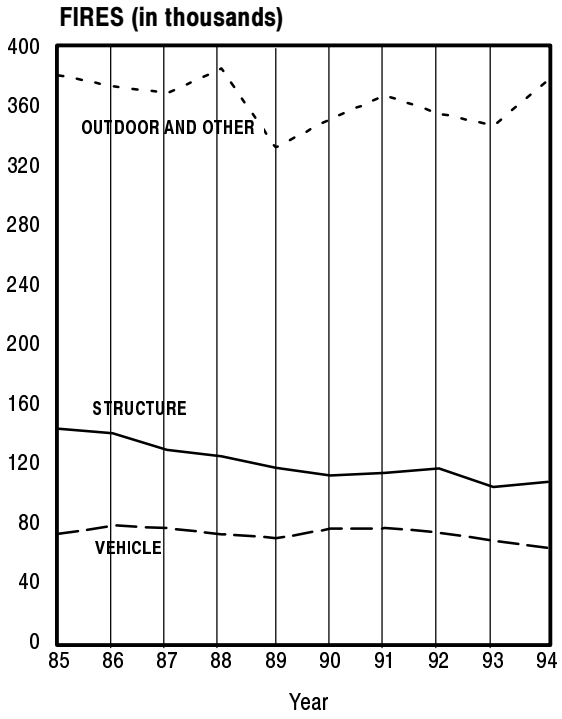
Sources: NFIRS and NFPA Annual Surveys

Figure 134. 1994 Arson Fires and Fire Losses by Major Occupancy Type

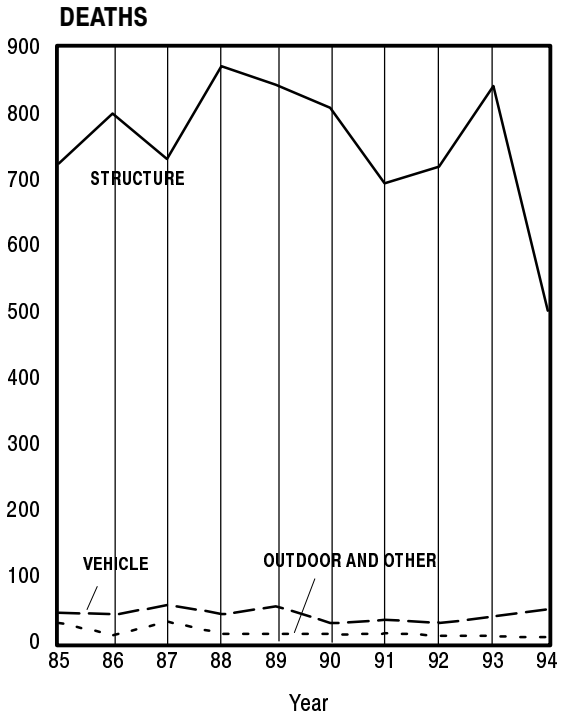
ARSON FIRES IN RESIDENTIAL STRUCTURES. The category "structures" includes both residential and non-residential properties. Analyzing these property types separately reveals that arson fires in residential structures account for higher losses than non-residential structures in terms of both fire deaths and fire injuries. Of all the people killed in arson structure fires in 1994, 96 percent were killed in residential structures according to NFIRS data. Similarly, of all injuries in structure fires caused by arson, 82 percent were injured in residential properties.

TRENDS IN ARSON FIRES. Figure 15, Chapter 2, shows that, overall, the number of fires occurring each year in the United States has fallen 19 percent over the past 10 years. Although the absolute number of arson fires occurring in structures has also fallen, the trend lines in Figure 136 show that arson in residential structures is decreasing slower than arson in non-residential structures (a 19 percent decrease versus a 34 percent decrease over 10 years). Consequently, the trend is for an increasing proportion of arson fires in any given year to be in residential structures. This is an important trend to watch given that higher losses, in terms of both lives and property, are associated with arson in residential structures than in non-residential or commercial structures.

While the number of residential deaths due to arson each year can vary substantially, Figure 137 reveals that over the past 10 years the overall trend has declined about 17 percent in the number of residential arson fire deaths. This is compared to a 32 percent decline in the overall number of residential fire deaths over the same period. Deaths in 1994 dropped to a 10-year low.



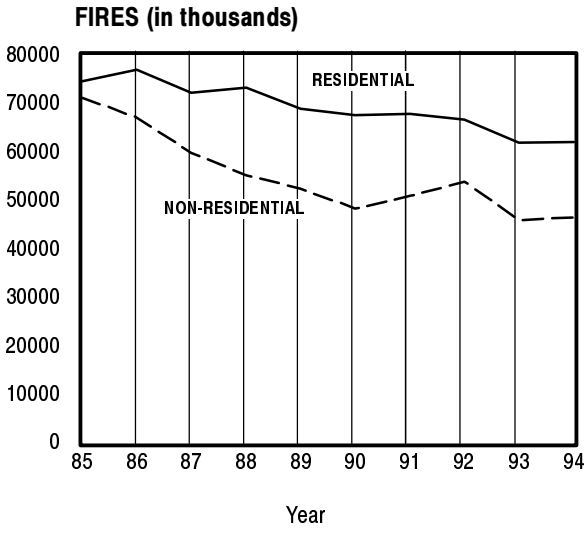
	Structure	Vehicle	Outdoor and Other
1985	143.6	72.9	381.0
1986	140.5	78.6	373.5
1987	120.1	76.5	368.9
1988	125.1	72.5	385.8
1989	117.0	70.0	332.6
1990	111.9	76.2	351.4
1991	113.9	76.8	367.4
1992	116.6	73.5	355.1
1993	104.4	68.2	347.2
1994	107.8	63.1	377.6



	Structure	Vehicle	Outdoor and Other
1985	724	45	30
1986	800	42	11
1987	731	57	31
1988	871	43	13
1989	843	55	13
1990	809	30	12
1991	694	34	14
1992	720	30	10
1993	841	40	8
1994	502	51	7

Sources: NFIRS and NFPA Annual Surveys

Figure 135. Trends in Arson Fires and Deaths by Major Occupancy Type

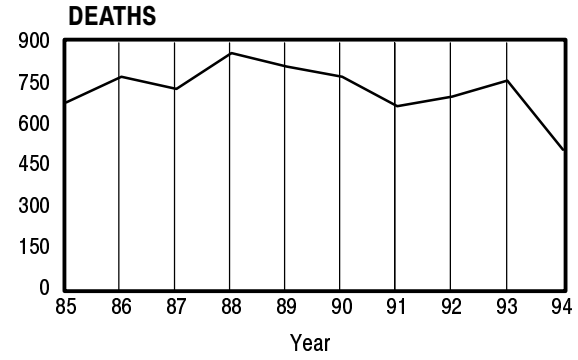


	Residential	Non-Residential
1985	74.6	71.1
1986	76.9	67.0
1987	72.2	60.0
1988	73.2	55.0
1989	68.8	52.4
1990	67.5	48.2
1991	67.7	50.9
1992	66.6	53.8
1993	61.9	45.9
1994	61.9	46.5

Residential 10-Year Trend = –34.0%
Non-Residential 10-Year Trend = –18.9

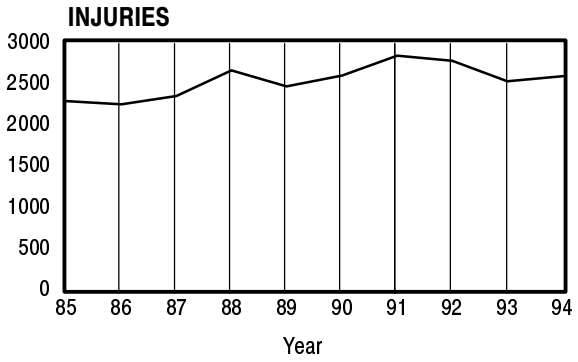
Sources: NFIRS and NFPA Annual Surveys

Figure 136. Trends in Non-Residential vs. Residential Structure Arson Fires



1985	677	1990	770
1986	770	1991	663
1987	727	1992	698
1988	857	1993	756
1989	809	1994	505

10-Year Trend = –16.7%



1985	2,280	1990	2,600
1986	2,250	1991	2,840
1987	2,340	1992	2,770
1988	2,660	1993	2,520
1989	2,460	1994	2,590

10-Year Trend = +17.6%

Sources: NFIRS and NFPA Annual Surveys

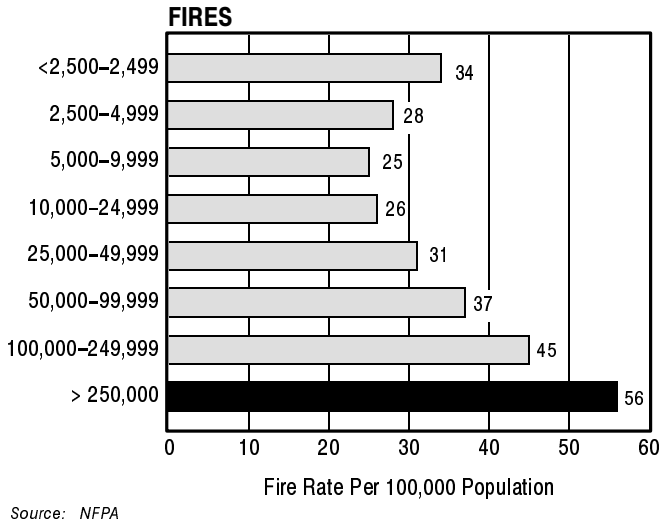
Figure 137. Trends in Residential Structure Arson Casualties

In contrast to the trend in arson fire deaths, the trend in residential arson fire injuries is upward—about 18 percent over the past 10 years. This is similar to the overall level of residential fire injuries, which have increased by 20 percent over the past 10 years.

METROPOLITAN VS. NON-METROPOLITAN RESIDENTIAL ARSON FIRES. While arson is among the leading causes of all residential fires, the data suggest that arson fires represent a higher proportion of all residential fires in metropolitan areas than in non-metropolitan areas. In 1994, arson fires comprised 14 percent of all residential fires with known causes and were the third leading cause of all residential fires. However, in metropolitan areas, arson fires accounted for 24 percent of residential fires and were the leading cause of residential fires. Cooking fires were second, accounting for 21 percent of metropolitan residential fires.[5]

This relationship between the character of place and the incidence of arson is borne out in other studies. A 1995 study by the National Fire Protection Association shows that for the period 1990–1994, the rate for incendiary and suspicious fires in cities of 250,000 or more was greater than twice the rate for communities of 5,000 to 10,000 or 10,000 to 25,000 (Figure 138). For rural areas with under 2,500 residents or with 2,500 to 5,000 residents, the rates were higher than for communities of 5,000 to 10,000, but lower than the rates for the largest places.

In the same study, NFPA reported that arson fires represented a higher proportion of all fires reported in large cities than in smaller cities for the period 1990–1994. The proportion of all fires attributable to suspicious and incendiary causes is more than two times higher in large cities than in smaller communities, as shown in Figure 139.



Source: NFPA

Figure 138. Severity of Arson Fires by Area Population Size (1990–94)

[5] United States Fire Administration. *Fire in the United States, 1983–1990*, Eighth Edition, p. 355. This information is intended to give readers a general idea of how metropolitan and national data compare, but it must be interpreted with care. Due to the way the data are collected and reported in NFIRS, some areas that are largely rural in character are included under metropolitan areas.

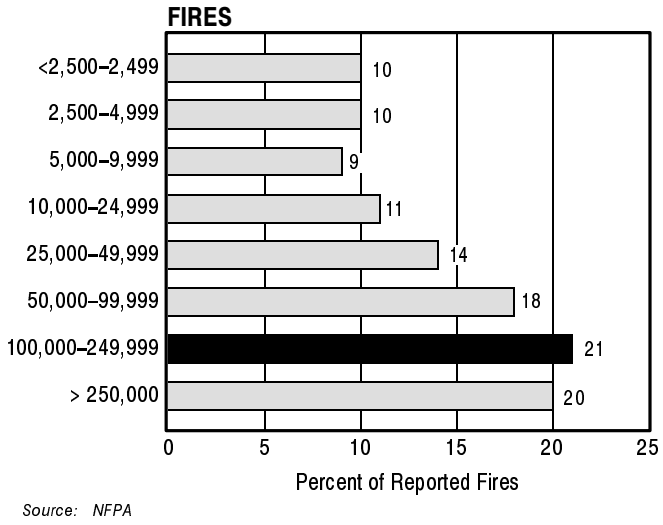


Figure 139. Arson Fires by Area Population (1990–94)

In another study, NFPA analyzed the types of structures that experienced arson fires and the distribution of arson losses between 1990 and 1994. The results appear in Figure 140. Residential structures experience the highest number of arson fires and account for the highest proportion of total arson dollar losses of all structure types. Important to note, however, is that while stores and offices experience only 6 percent of all arson fires, they account for 20 percent of all dollar losses resulting from arson fires.

Characteristics of the Arson Problem

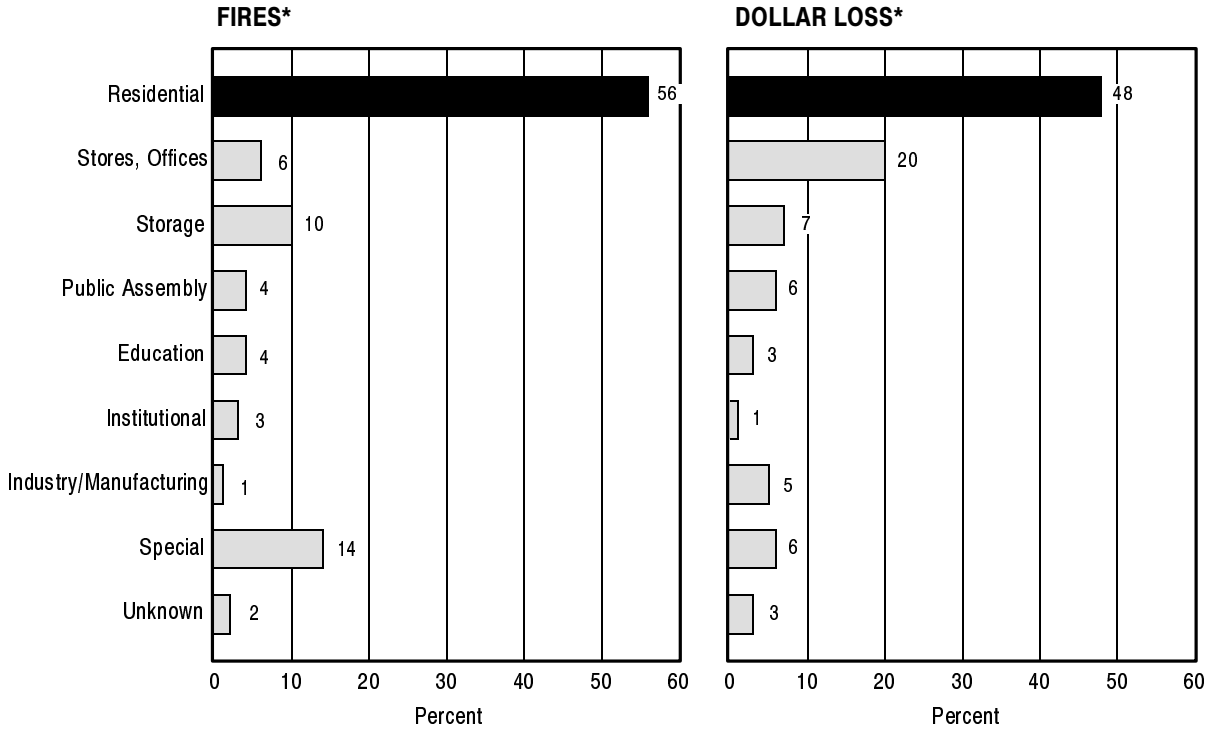
TIME OF DAY. Figure 141 shows the distribution of arson fires throughout the day for 1994. The two time periods with the highest proportion of arson fires are from 4 p.m. to midnight. This period accounts for almost half of all arson fires.

DAY OF THE WEEK. Figure 142 shows the distribution of arson fires throughout the week for 1994. Although arson fires are fairly well distributed throughout the week, there are proportionately more on Saturday and Sundays. Together, these weekend days account for almost one-third of all arson fires.

FIXED PROPERTY USE. Figure 143 shows the distribution of the types of properties that experienced arson fires in 1994. The six categories of fixed property that experienced the highest number of arson fires are listed. Together, these properties accounted for 80 percent of the fixed property use types that experienced arson fires.

Motives of the Firesetter

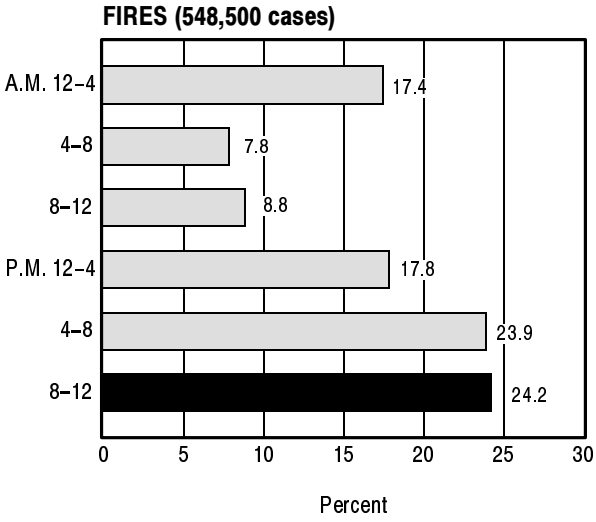
As with any crime, people set arson fires for varied and complex reasons. For the purposes of prosecuting criminals in other types of criminal cases, motive is often a secondary consideration and



*Numbers of cases and actual dollars are not reported by NFPA.

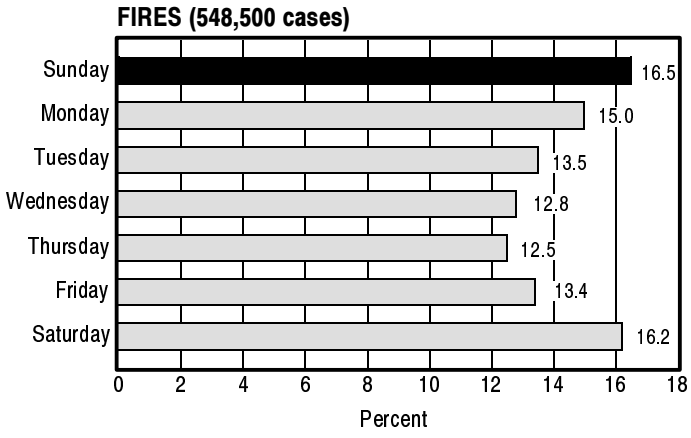
Source: NFPA Annual Surveys

Figure 140. 1990–1994 Arson Fires and Dollar Loss by Property Type (1990–94)



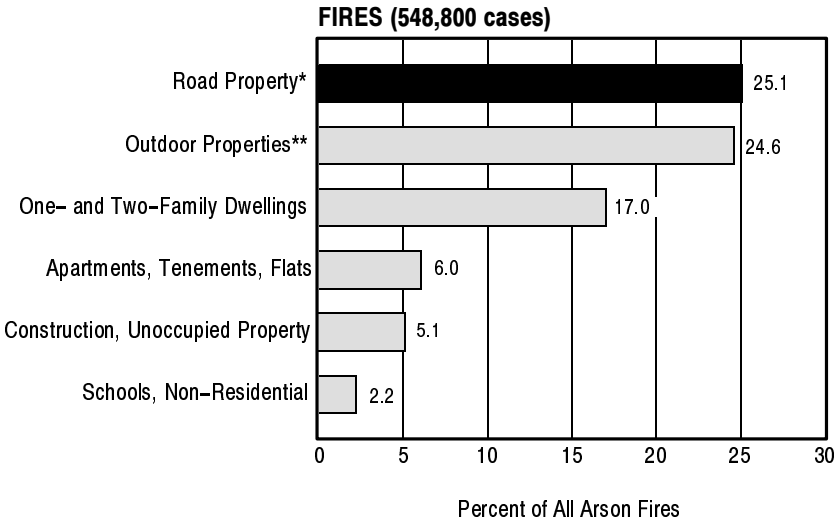
Source: NFIRS

Figure 141. Time of Day of 1994 Arson Fires



Source: NFIRS

Figure 142. Day of Week of 1994 Arson Fires



* Refers to vehicle fires.
** This is one of the NFIRS categories that refers to outdoor fires.

Source: NFIRS

Figure 143. Fixed Property Use of Locations Experiencing 1994 Arson Fires

is not necessarily crucial for conviction. But because arson is a clandestine crime where witnesses are rare and some or most of the direct evidence may burn in the fire, motive becomes a critical element in prosecuting firesetting cases. Pinpointing the motivation for setting a fire helps identify suspects and helps convince a jury of the accused's guilt. The most common motives behind firesetting are:

- Vandalism
- Spite and revenge, including angry spouses, ex-spouses, and boyfriends and girlfriends; disgruntled employees or former employees; and gang-related retaliation

- Intimidation
- Concealment of a crime

- Economic motives, including insurance fraud, debt removal, direct monetary gain, elimination of unwanted ownership, land assembly for development, and removal of business competition
- Emotional/psychological dysfunction, including juveniles in crisis; vanity ("hero" and attention), especially fires set by firefighters; and pyromania.

Of particular concern is the involvement of juveniles in intentionally set fires. The NFPA reports that in 1994, for the first time, juvenile firesetters accounted for a majority (55 percent) of those who were arrested on arson charges.[6] The growing involvement of youths in setting fires is cause for serious concern and deserves more attention from policymakers.

In a U.S. Fire Administration-sponsored management assistance project, investigators from nearly 60 state and local fire investigation units ranked spite and revenge as the most frequent motive behind incendiary fires. This is a common motive for both adult and adolescent firesetters. A fire set by someone bent on revenge is a premeditated act directed at an individual he or she knows and wants to hurt, such as a former spouse or business partner. Consequently, these tend to be the most dangerous fires in terms of casualties because volatile emotions motivate the crimes. Other spite and revenge arsons include gang-related fires that are set to exact revenge against rivals or their rivals' sympathizers.

Fires set for the sport of vandalizing property were ranked high as motives in the USFA study. Juveniles were responsible for the majority of these arson cases.

Some arsonists use fire to conceal companion crimes such as murder, embezzlement, or burglary. For example, fire death victims have been found with bullet wounds, which is why it is important to conduct autopsies on all fatalities found in fires. Medical examiners can determine whether fire or other causes resulted in the death.

There is some debate as to the relative frequency of fraud as a motive for arson. Although arson done for direct profit or to eliminate debt remains a problem, there are signs that this is less frequently behind firesetting today than it had been previously. One of the complications in assessing the frequency of arson cases motivated by fraud is that they tend to be more complex than other types of cases and require more investigation time.

Given the destructiveness of arson fires, a better understanding of their occurrence and nature is needed. Particularly important is more data on the incidence of arson fires and the motivations of arsonists in setting them. The National Fire Incident Reporting System only collects "cause" of fire data; no additional information is collected on incendiary fires. Unless all suspected cases of

[6] Hall, John R. Jr., *U.S. Arson Trends and Patterns—1994*. Quincy, MA: National Fire Protection Association, 1995, p. 3.

arson are pursued and classified as incendiary or suspicious via reporting systems such as NFIRS, our understanding of the arson picture in the United States will remain incomplete. One possibility is to develop a national protocol on collecting data on incendiary and suspicious fires. This would allow collection of data critical to understanding the nature of the arson problem, including types of firesetters, firesetter motives, and prior histories of firesetting among firesetters.

There are many challenges to collecting quality data, and primary among these are circumstances at the local level that may complicate data collection processes. Inadequate investigator training in some areas, particularly rural areas, means that many fires of an incendiary or suspicious nature are not identified and do not get fully investigated. Also, budgetary constraints or other demands on staff have reduced the level of fire and police resources available to investigate suspected arson cases. These circumstances exist even though many are aware that closer cooperation between fire and law enforcement officials is critical to stemming the tide of arson fires. Without thorough investigations and, as importantly, the willingness of local prosecutors to pursue cases against suspected arsonists, it is difficult to make headway in the effort to reduce the incidence of arson fires in the United States.

WILDLAND

Wildland fires have long been a concern of the rural residents of the United States, impacting the culture in many ways. Fire is a tool used by farmers to clear their fields after harvest and is an important ecological factor in wilderness areas. The general public's awareness of fire has grown over the last 25 years as the country's urban areas continue to expand into formerly rural and wilderness areas. The zone where communities and wildland fire characteristics overlap is now described as the wildland/urban interface. The last three decades have seen significant growth of the population living in the interface zone, and several catastrophic fires that have occurred there demonstrate the seriousness of this growing problem.

History

Catastrophic fires are not a new phenomenon in this country. In the fall of 1871, more than 800 people were killed and all but one structure destroyed in Peshtigo, Wisconsin, in what we would describe today as a wildland/urban interface fire. The early twentieth century saw a continued debate about the role of fire and the value of deliberate fires for clearing land and for lessening the chance of larger catastrophic fires by clearing fuel—a prescribed burn. The birth of the U.S. Forest Service in 1905 marks the beginning of a concerted and focused effort on the part of the government to extinguish wildfires. The commitment to fighting fires and the country's belief that they should be fought at nearly any cost was reinforced by the dramatic and historic fires of 1910 in which 5 million acres burned and 78 firefighters lost their lives. Internally, the Forest Service set itself the objective of having a fire under control by "10:00 a.m. the next morning."

The efforts to control fire were so effective over several decades that there has been a build up of fuels in many wildland areas that normally would have been consumed by periodic fire. The federal agencies recognized this growing ecological and fire hazard and modified their firefighting approach to "let burn" fires that were within a prescription for a given area. This translated into aggressive firefighting in areas abutting towns and communities and a less aggressive effort on fires that were burning in wilderness areas as long as the weather and other factors were within set limits, and there was a "natural" and desirable impact on the ecology. This was the case in Yellowstone in 1988 when fires that were originally "in prescription" went out of prescription and burned large areas of the park. The Yellowstone fires brought the issue of wildfire back into the realm of national debate, which continues today.

Many foresters advocate the use of "prescribed fire," that is, fire that is set during low fire danger periods, to remove fuels and thereby lessen the chance of large catastrophic fires. Using prescribed fire does entail the risk of it "escaping" and burning beyond the objectives set forth when it was lit. Also, smoke from a prescribed fire is the same as from a wildfire and is equally unpopular with residents of nearby communities. But despite the risks, prescribed fires are considered a tool for avoiding even larger risks from extremely large fires. The role of prescribed fire continues to be debated within the federal agencies that fight fire, at the state level, and by the public.

Interface Challenge

From 1985 to 1994, nearly 9,000 homes were destroyed by fire in interface areas.[7] The people who move into interface zones often do so because of the proximity to rural and wildland areas. They pride themselves on the integration of their homes into the surrounding vegetation. Unfortunately, the dictates of taste are often in contrast to the concept of "defensible space" and other steps homeowners can take to defend against interface fires.

The Wildland/Urban Interface Fire Protection Program has identified four common components of the interface fires it has examined. First, low relative humidity, high temperatures, and high winds often are in place before the fire starts. Second, human activity such as arson, debris burning, or downed electrical wires cause many interface fires. Third, many of the homes destroyed are constructed of combustible material or have especially vulnerable features such as wood shingle roofs. Fourth, a lot of combustible materials surround the home, such as woodpiles or fences.

As people relocate into the wildland/urban interface, they may bring with them a perception that, as is the case in urban areas, local fire departments are capable of handling virtually all of the fires that occur. The reality is that the interface presents a different set of risks than is usually faced by urban departments.

[7] *NFPA Journal*, March/April 1994, p. 84.

For example, in August of 1992 the Fountain Fire in Northern California burned 64,000 acres of forest land and destroyed 330 homes, 37 businesses, and more than 200 other structures.[8] Although overwhelmed, the system was not caught off guard, mutual aid agreements were in place, and all those called on responded quickly. But the fire overwhelmed the ability of the local fire jurisdiction. The suppression costs were over $20 million in tax dollars and losses were over $105 million, but no one died in the fire.

In 1991 the Oakland Hills fire overwhelmed the Oakland Fire Department. It destroyed 3,000 structures and killed 25 people in one of the most densely populated metropolitan areas in the United States. Fire officials in the Bay Area were well aware of the risk of such a disaster and had predicted that such a fire would eventually occur. No one predicted the over $1 billion worth of damage or how completely overwhelmed the fire suppression system would be. Residents abandoned their homes and fled by foot as firefighters and police officers retreated in the face of the oncoming walls of fire. For the first several hours, the fire was completely out of control and free to burn where it wished. Frantic callers who were able to reach 911 expecting to be told a fire engine was on its way were told instead to gather their family and evacuate the area.

It is estimated that $250–$300 million of the federal wildland fire suppression budget was spent in protecting the wildland/urban interface in 1994.[9] The role of federal government in wildland/urban fire protection is not completely defined or coordinated. Except for the National Park Service, the federal agencies involved in fire suppression do not have specific responsibilities to protect structures. And the Park Service structural responsibility is limited to only those structures located on NPS land. Although agency mission statements do not include responsibilities for structural protection, federal wildland resources are often expected to come to the aid of nearby communities during interface fires.

Mitigation

The lack of public enthusiasm for interface fire mitigation is a significant issue. Local communities are reluctant to enact zoning regulations and building codes that might decrease the risk of interface fires because of the associated increase in building cost and public opposition to further regulation. Some have suggested that property insurers should move to reward wildfire-awareness construction through reduced premiums. Insurance companies currently set premiums based on zone or neighborhood characteristics, not on individual homeowners' efforts to decrease the vulnerability of their own property. Some programs are underway, however, that might become models for interface mitigation. Summit County, Colorado, is incorporating hazard and risk assessment into zoning requirements. Other communities are working to educate property owners about the risk of interface fire and what they can do to reduce the risk. A state forester in Colorado observed that new

[8] *Fire Protection in the Rural American: A Challenge for the Future*, 1994, p. 16.
[9] "Interface," *Federal Wildland Fire Policy and Program Review Report*, 1995.

residents moving from wildland fire-prone areas of California are bringing their interface awareness with them.

Most of the structures destroyed in interface fires are destroyed in the first few hours of the fire when the fire suppression resources are overwhelmed. The public must recognize the potential of interface fire. Local governments need to educate their citizenry about wildfires and support efforts. Citizens must work with their local government to ensure that the risks are reduced before a fire starts. This is achieved by maintaining a defensible space around their property, using fire-resistant materials, and employing fire-wise landscaping.

Special Concerns for the Future

More people are moving into interface zones. And more forests have declining health and greater fuel buildup. The result is a growing number of potential wildland fires of high intensity that will threaten homes and communities. These fires are also a greater threat to firefighters, who not only have a more severe fire to contend with but will also probably have to fight the fire differently when it is in the vicinity of homes. Federal and state funding cutbacks have reduced the number of wildland firefighters, so more of the burden of initial attack on a wildland fire is shifting to rural fire departments. In many cases, these are small volunteer fire departments with inadequate wildland fire training or equipment. In turn, this raises the risk to both the firefighters and the communities. Fire resources, public expectations, and prevention/mitigation efforts have to be better balanced to effectively address this growing fire problem.

TOTAL COST OF FIRE IN THE UNITED STATES

Over the last two decades, many attempts have been made to estimate the total annual cost of fire in the United States. The total annual cost is much greater than just the value of property destroyed by fire. The total cost includes the cost of fire services; the cost of fire protection built into buildings and equipment; the cost of fire insurance overhead; the many indirect costs, such as business interruptions, medical expenses, and temporary lodging; the value to society of the injuries and deaths caused by fire; the cost of government and private fire-related organizations; and the myriad of other related costs that add up to a very large economic impact. The same is true for any industrialized nation, but most nations have not estimated this total cost at all, and very few have done it in detail.

The total loss of fire is on much larger scope than people think, in the range of $60 to $120 billion a year, depending on how it is defined and the estimation methodology used. The first modern attempt to estimate the total cost of fire for the United States was undertaken by the U.S. Fire Administration as a project for a team of fire protection engineering students from Worcester Polytechnic Institute (WPI) circa 1980. This initial estimate was based on first-cut thinking about the problem and has been widely disseminated.

A more recent effort to estimate the total cost of fire was made in 1993 by William Meade, an economist for the National Institute of Standards and Technology.[10] It made initial estimates of some new cost areas that, though crude, have yet to be improved upon.

Dr. John Hall, the head of fire data analysis at NFPA (and a former USFA fire data analyst), has made a series of estimates of the total cost of fire built on the WPI and Meade estimates, with further development of the methodology. His most recent estimate of the total cost of fire was released in 1995.[11] The total cost of fire protection is much greater than most would suspect. In 1983 the total cost of fire was conservatively estimated by Hall to be on the order of $32.9 billion. By 1993, the estimate had grown to $45.5 billion, an increase of $12.6 billion over a 10-year period. Much of this increase can be attributed to inflation. Using a broader definition of costs—including an estimate of the value of volunteer firefighters labor—Meade estimated the total cost of fire to be between $92 to $139 billion (Table 17).

Table 17. Summary of Total Cost of Fire

Cost Component	Range of Cost Estimates ($ billions)	Most Likely Estimate ($ billions)
Category A: Losses		
Residential Property	4.0	4.0
Industrial Property	4.2	4.2
Other Property	0.7	0.7
Residential Interruption	0.6–1.0	0.8
Business Interruption	6.1–8.4	8.4
Product Liability	3.5	3.5
Category B: Insurance		
Product Liability	0.1	0.1
Net Fire Insurance	5.6	5.6
Category C: Fire Service		
Paid	9.6	9.6
Volunteer Conversion	16.2–36.8	30.0
Category D: Preventative		
Built into Structures	20.7	20.7
Built into Equipment	13.5–22.5	18.0
Standards Activity	0.1–0.6	0.2
Retardants/Testing	1.9–4.0	2.5
Fire Maintenance	4.3–16.6	6.5
Disaster Recovery	0.6	0.6
Total	91.7–138.9	115.4

Source: Meade, William, *A First Pass at Computing the Cost of Fire in a Modern Society,* The Herndon Group, March 1991; prepared for Center for Fire Research, National Institute of Standards and Technology, Gaithersburg, Maryland.

[10]Meade, William, *A First Pass at Computing the Cost of Fire in a Modern Society,* The Herndon Group, March 1991; prepared for Center for Fire Research, National Institute of Standards and Technology, Gaithersburg, Maryland.

[11]Hall, John, *The Total Cost of Fire in the United States Through 1993*, NFPA Report, October 1995.

Total Cost Components

When people talk about the cost of fire, the most common statistic quoted is *direct losses from fire*—what was burned up or damaged by fires—but this is only a small fraction of the total. Other categories of losses and costs must be taken into account to fully estimate the total cost of fire.

A second type of major cost category is the *cost of the fire service*. People often focus on the fires themselves and forget the cost to the public and government to maintain a "ready army" of firefighters, equipment, and stations. This includes the cost of local paid and volunteer departments, forest fire management, and even the portion of the municipal water supply attributed to the cost of fire protection. For example, some water mains are sized to meet firefighting needs and are larger than would be necessary for household water supplies.

Insurance overhead is the cost paid by the public for insurance less what is returned to the public in payments for insured losses (which are accounted for as part of direct losses).

There is also an *indirect loss from fire*, including business interruptions, costs of temporary lodging, tax losses, loss of market share, legal expenses, and many other categories. This is one of the most difficult categories to estimate with a high degree of accuracy.

Another category of costs is the cost of *fire protection built into buildings, equipment, infrastructure, and business operations*. Built-in fire protection in buildings is hard to quantify. Much of the built-in protection against fire also provides protection from other hazards (e.g., thick walls offer resistance to fires and provide structural integrity, electrical safety features reduce the hazard of electrical shock as well as fires).

The cost of fire protection built into equipment is even more difficult to estimate because there are so many more types of equipment than buildings. Equipment ranging from color TVs to portable space heaters to cigarette lighters have special features to prevent them from becoming the "equipment involved in ignition."

The cost of operations affected by fire considerations includes the training of employees in fire safety, cost of special transportation for flammables, the use of special containers for flammables, and work time lost evacuating buildings from false alarms.

Finally, there is the *cost of deaths and injuries* to society. Part of these costs are conceptually clear if difficult to estimate, such as the cost of medical treatment, funeral expenses, and time lost from work. Other, more conceptually difficult and, to some, distasteful costs to include are the value of a life and of pain and suffering. Estimating these aspects of losses is often done as part of cost effectiveness studies in other fields.

The most recent list of components of the total cost of fire is in Table 18. This was done for a study of the cost of fire in Canada.

Table 18. Elements of the Total Cost of Fire

Type of Cost (and Major Components)	Percentage of Total Cost
I. Direct Dollar Losses from Fires • Fires reported to the states by the fire service or insurance companies • Fires that go unreported to the fire service and insurance companies • Wildland fires	15
II. Cost of Fire Services • Municipal career or part-paid fire departments – Personnel (including benefits/social costs) – Hardware: Fire apparatus, supplies, equipment, vehicles – Stations – Water system (fire-related cost) • Volunteer departments – Hourly or per-call wages – Equipment – Pensions – Attributed cost of replacing volunteers (option to include) • Industrial fire brigades • State and national fire forces (including state fire marshal offices) • Military firefighting forces • Management of forest fires	20
III. Cost of Fire Protection in Structures (Buildings and Other Engineered Structures) • Active fire protection systems – Detection, alarms, sprinklers, halon, and other suppression agents – Extinguishers, standpipe systems, smoke control systems • Passive fire protection (above structural needs) – Fire-related construction elements (e.g., fire-rated ceilings, floors, walls, doors, cladding, compartmentation, trenches for containing liquids in chemical plants) – Extra exiting – Extra spacing between structures (land value) • Fire protection in building systems – Fire-rated components and design of permanent electrical and mechanical systems • Infrastructure costs (e.g., wider roads and turnarounds for fire vehicle access)	28
IV. Cost of Fire Protection in Equipment, Vehicles, Goods, and Industrial Operations *(Beyond what is needed to function or for shock protection, such as tipover switches in kerosene heaters, gas shutoff valves, protection around fuel tanks in cars)* • Equipment and vehicles – Civilian – Military (ships, planes, etc.) • Industrial operations (e.g., fire safety training, fire drills; electrical, gas, and oil industry safety operations)	20
V. Insurance Overhead and Profit • Total cost of premiums less payouts	3

Continued on next page

Table 18. Elements of the Total Cost of Fire (continued)

Type of Cost (and Major Components)	Percentage of Total Cost
VI. Indirect Losses From Fires • Indirect losses to businesses, including: – Business interruption losses – Temporary displacement expenses – Long-term losses in market share – Secondary losses in dependent businesses • Indirect losses to residences, including: – Temporary lodging, vehicles, and other living expenses • Litigation expense – Legal costs (before and after a fire) – Settlements • Tax losses • Environmental impacts of fires and fire protection (e.g., halon impact on ozone layers; aquifer damage from runoff of contaminated water; air pollution)	3
VII. Attributed Cost of Lives Lost and Injuries From Fires • Civilian and firefighter fatalities (reported and unreported) – Medical costs, funeral costs, attributed value of life lost • Civilian and firefighter injuries (reported and unreported) – Medical expenses, attributed cost of pain, suffering, and lost income	10
VIII. Miscellaneous Costs • Regulatory, research, and testing • National and state fire agencies and associations • Disaster recovery	0.9
Total	100

Source: Schaenman, Philip, et al., *Total Cost of Fire In Canada,* The National Research Council of Canada Fire Research Laboratory, December 1994.

Conclusion

The total cost of fire is very large. Different sources estimate the cost at perhaps as much as 6 to 12 times higher than the direct losses alone. This puts fire protection up among the larger national problems in terms of its economic impact. The full magnitude of the problem is probably underappreciated by the general public, media, and elected officials. The total cost is important to estimate when considering priorities across programs.

It also is important to consider each major cost element and tradeoffs among them when making fire protection policy. For example, the size of the fire service affects losses; the extent of built-in protection affects the cost of fire services and the losses; insurance overhead should be affected by the number and size of losses, etc. Analysis of changes in incremental costs of the major components of the total cost of fire should be given more consideration in setting priorities than it is usually is.